Software Project Status

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BNL

DOE/NSF Review of US LHC Software and Computing

Fermilab

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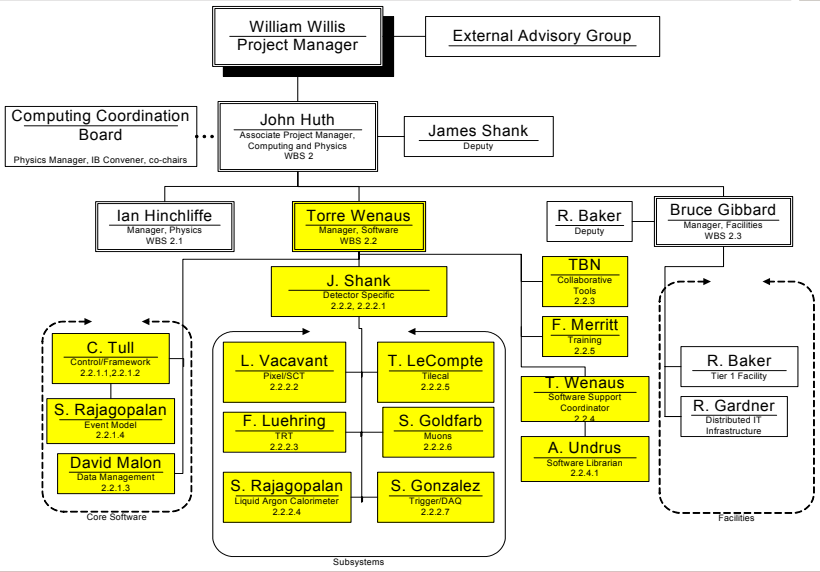
Outline

- Project overview
  - Scope, organization, planning, relation to Int'l ATLAS
- Technical progress
- Schedule
- Budget and personnel
- Comments and conclusions

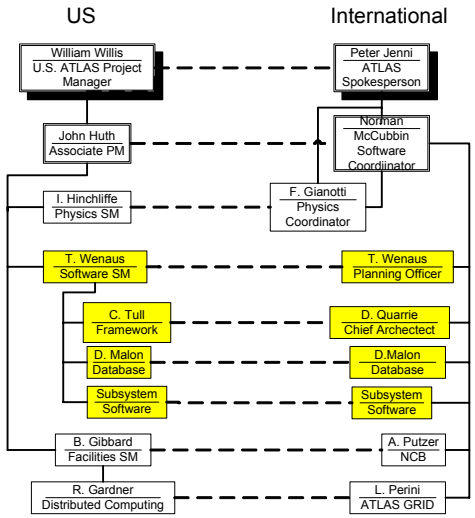
U.S. ATLAS Software Project Overview

- Major roles in key core software domains which leverage U.S. capability and are central to U.S. physics analysis
  - Control framework and architecture
    - Chief Architect, principal development role. Software agreement signed.
  - Databases and data management
    - Database Leader, major development roles
  - Specify US roles via software agreements with International ATLAS
- Software support for development and analysis
  - Software librarian, quality control, software development tools, training…
- Subsystem software roles complementing hardware responsibilities
  - Closely coupled to core development in a tight feedback loop
- Leadership roles commensurate with our activities
- Scope commensurate with U.S. in ATLAS: ~20% of overall effort

U.S. ATLAS Software Organization



U.S. ATLAS - ATLAS Coordination



US roles in Int'l ATLAS software:

D. Quarrie (LBNL), Chief Architect

D. Malon (ANL), Database Coordinator

P. Nevski (BNL), Geant3 Simulation Coordinator

H. Ma (BNL), Raw Data Coordinator

C. Tull (LBNL), Eurogrid WP8 Liaison

T. Wenaus (BNL), Planning Officer

ATLAS Subsystem/Task Matrix

	Offline Coordinator	Reconstruction	Simulation	Database
Chair	N. McCubbin	D. Rousseau	K. Amako	**D. Malon**
Inner Detector	D. Barberis	D. Rousseau	**F. Luehring**	S. Bentvelsen / D. Calvet
Liquid Argon	J. Collot	**S. Rajagopalan**	**M. Leltchouk**	R. Sobie
Tile Calorimeter	A. Solodkov	**F. Merritt**	A. Solodkov	**T. LeCompte**
Muon	To be named	J.F. Laporte	A. Rimoldi	**S. Goldfarb**
LVL 2 Trigger/ Trigger DAQ	S. George	S. Tapprogge	M. Weilers	A. Amorim / F. Touchard
Event Filter	V. Vercesi	F. Touchard		

Project Planning Status

- U.S. ATLAS WBS based on XProject essentially complete
- XProject extended to support International ATLAS; integration in International ATLAS by Helge Meinhard complete
  - Detailed U.S. WBS integrated into ATLAS PBS
    - U.S. and ATLAS versions mostly coincide (wherever possible)
  - ATLAS and U.S. ATLAS schedules fully integrated
- U.S. and ATLAS project management cooperating and in synch
  - Common WBS and schedule sources in ATLAS CVS
  - 'Projections' from common sources differentiate the projects
- Projections also used for grid planning: 'US Grid Computing WBS'
- CMS, PPDG, EUDG also using/evaluating XProject

ATLAS Planning Officer

- The Planning Officer is responsible for
  - proactively **requesting and gathering schedule input** from project coordinators
  - assessing **consistency** with the rest of the project and **completeness**
  - **iterating** as necessary to maintain a credible schedule
  - maintaining the schedule and PBS using the agreed **project management tools** (currently **XProject**)
  - **presenting** these materials in useful forms on the web, and reporting schedule status
  - Ensuring adequate **technical support** for project management tools in use,
- Schedule should be reasonably detailed 1-2 years out, and should cover major milestones through the life of the project
- The Planning Officer participates by invitation in those parts of CSG meetings related to planning, and reports to the Computing Coordinator.

Progress Overview

- Control Framework and Architecture
- Databases
- Software Support and QA/QC
- Grid Software

Control Framework and Architecture

- Architecture review is concluded and dissolved. Athena is endorsed and in use throughout ATLAS
- StoreGate transient event model evolution and adoption has moved rapidly, with almost all reconstruction software now using it
- Data Dictionary prototype being developed to implement autogenerated event object descriptions and persistency mechanisms
- User and developer guides written
- ATLAS migration to CMT code management a large drain on developers generally and D.Quarrie in particular. Now completed.
- LBNL developer C.Day replaced by a postdoc, to save money
  - FTE count constant at 5.5 (4.5 from project). Scripting development delayed

Databases

- D.Malon now sole ATLAS DB coordinator – congrats! A positive step.
- Objectivity-based event store deployed to Lund users and will be used in DC0
- DB technology decision at end 2002, based on evaluations in DC1
- Event store architecture design document released in September
  - Excellent basis to proceed. Fully consistent with both Objectivity and hybrid ROOT/RDBMS technologies which are to be evaluated in DC1
  - One of its principal authors, Ed Frank (UC), is unfortunately leaving HEP
    - Reduces ANL-area DB effort by 0.5 FTE to 3.5 (3.0 supported by project)
- Event store work on the hybrid solution is beginning to ramp
  - Prototype deployment in time for DC1's technology evaluation (spring)
    - First component, ROOT persistency service, incorporated in latest release
  - Progress depends on transferring expertise from STAR, which has a production hybrid event store. Requires that the planned BNL ramp proceeds.
  - Hybrid event store now a hot topic. Will seek to establish a common project.
- Planning the process for evaluation and decision on event store is a top priority

Software Support, Quality Control

- New releases are available in the US ~1 day after CERN
  - Provided in AFS for use throughout the US
- US-developed nightly build facility used throughout ATLAS
  - Full software build based on most recent tags; email to developers
  - Now an integral part of the release process
  - Recently moved from BNL to CERN to better support the whole community
  - Framework for progressively integrating more QC & testing
- When CMT stabilizes, nightlies will be extended to incorporate more QC
  - Code compliance, component testing, large scale 'chain' testing
  - Leveraging the experience of a recently hired QC expert
    - Component testing proposal submitted to ATLAS and being prototyped
- Deploying **pacman** (Boston U) for remote software installation

Grid Software

- Major new US grid projects approved (PPDG SciDAC, iVDGL) and must be leveraged to contribute as much as possible to ATLAS while respecting the programs and deliverables of the grid projects
- Software development within the ATLAS complements of the grid projects is being managed as an integral part of the software effort
  - Objective is to integrate grid software activities tightly into ongoing core software program, for maximal relevance and return
  - Grid project programs consistent with this have been developed
- Grid goals, schedules integrated with ATLAS (particularly DC) program
- This does **not** mean that eg. PPDG FTEs can be subtracted from our project needs; grid projects lead to scope extensions and priority redirections that are a challenge for us to accommodate as it is

Schedule

- Integrated (U.S. software + U.S. grid + ATLAS), comprehensive schedule
  - Linked to U.S. ATLAS, ATLAS, U.S. Grid WBS's throughout
  - Supports, but does not yet show most linkages between tasks/milestones
- Reasonable detail for near term; sketchier beyond that
  - Currently developing and adding detail for 2002-2003, particularly Data Challenge related
    - Need to return to and sustain a schedule that is detailed ~2 years out
  - Little schedule development in International ATLAS since the spring
  - Schedule development ('planning officer') a US responsibility since Nov 22
- WBS and schedule are input to the U.S. ATLAS project management accounting and tracking system

Summary Software Milestones

The Data Challenges will frame our objectives and milestones in 02, 03

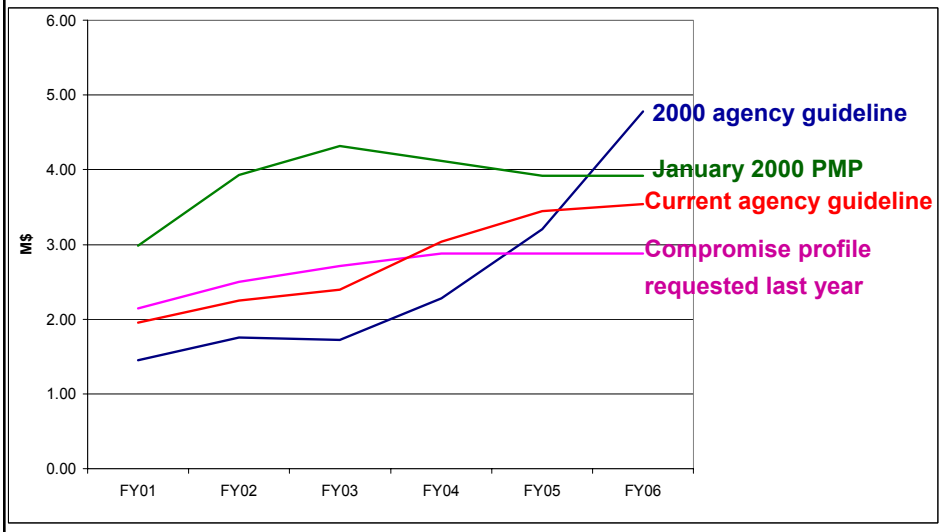
		0	1	2	3	4	5	6
1 Tbyte database prototype	(Done)							
Release of Athena pre-alpha version	(Done)							
Athena alpha release	(Done)							
Geant3 digi data available	(Done)							
Athena beta release	(Done)							
Athena accepted (ARC concluded)	(Done)							
Athena Lund release	(Done)							
Event store architecture design document	(Done)							
Athena production release V1 (DC0)								
Decide on database product	Delay							
DC0 - 100k events								
Full validation of Geant4 physics	Delay							
DC1 Completed - 10M events								
Computing TDR Finished	Delay							
DC2 Completed - 10% of nominal data								
Physics readiness report completed								
Full software chain in real environment								
Full DB infrastructure available								

Slippage is apparent; LHC startup delay is likely to be swallowed by the lengthening schedule

Agency Budget Guidelines

- Original agency profile of monies in software FY01-06 was an *impossible* one for software
  - Sharp, late peak like the profile of a failed project
  - Fitting the profile makes critical mass at any US site impossible
  - Dismissals of valuable HEP experts would have been necessary
- We developed a 'compromise profile' well below our Jan 2000 proposal which provides the needed flatter profile
  - The current agency profile is better but still too back-loaded, falling short until FY04
  - Shortfall in FY03 could delay the ongoing transfer of hybrid event store expertise from STAR to ATLAS
  - No funds until FY04 for dedicated CERN presence

SW Funding Profile Comparisons



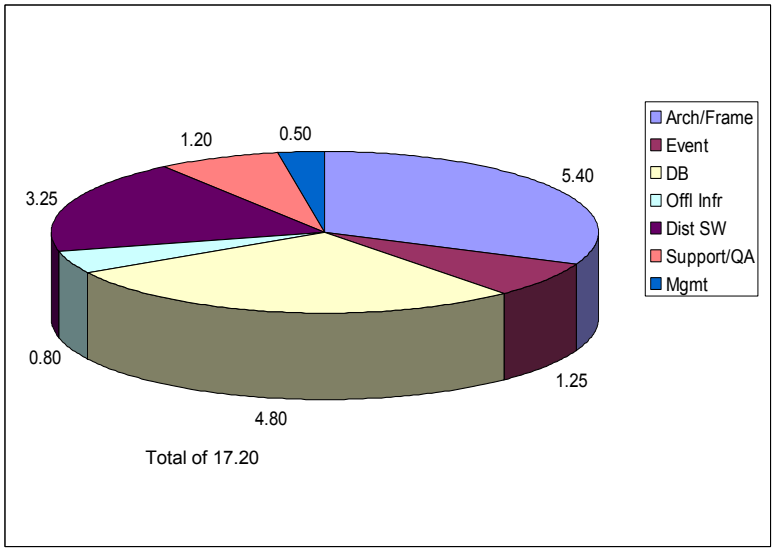
Budget (= Personnel) Priorities for FY01

- FY01 priorities suffered due to funding shortfalls
  - Sustain LBNL and ANL efforts
    - Highly experienced LBNL developer released, to be replaced by young programmer, to reduce cost while preserving FTE count
    - Highly experienced U Chicago developer working with ANL DB team (50% level) is leaving. No resources at present to replace him
  - Begin the delayed BNL ramp: Add first sw pro developer
    - First sw pro was added, but 1FTE of base support was lost. Temporarily compensated with lab resources.
  - Establish sustained presence at CERN
    - Unfunded. 1 person is at CERN via existing funds (LBNL relocation)

Personnel Priorities for FY02, FY03

- FY02, FY03 priorities are also in jeopardy
  - Sustain LBNL (4.5FTE) and ANL (3FTE) support
    - We hope the recent cutback will be sufficient.
  - Add FY02, FY03 1FTE increments at BNL to reach 3FTEs
    - FY02 is in the budget. FY03 only partially fits in the profile. FY03 involves no new hire; transfers ROOT expertise from STAR.
  - Restore the .5FTE lost at UC to ANL
    - No resources, based on profile
  - Establish sustained presence at CERN.
    - No resources, based on profile
- We rely on labs to continue base program and other lab support to sustain existing complement of developers

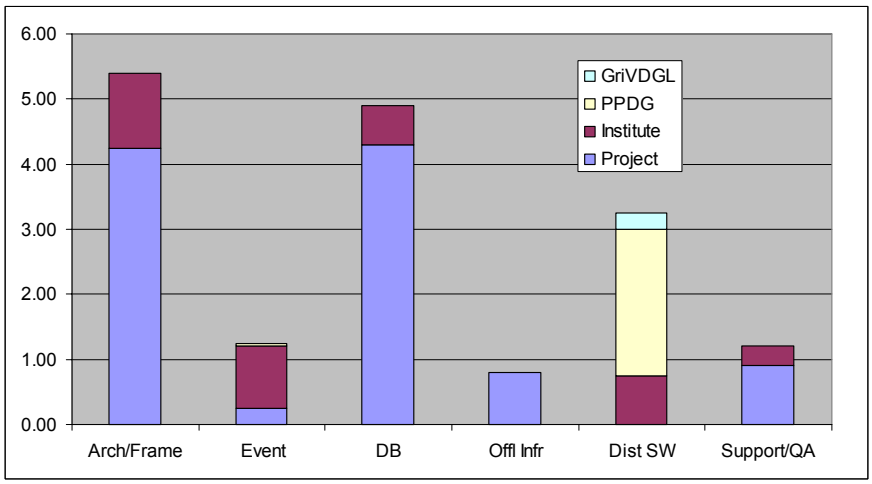
FY02 Software FTEs by Category



Total of 17.20

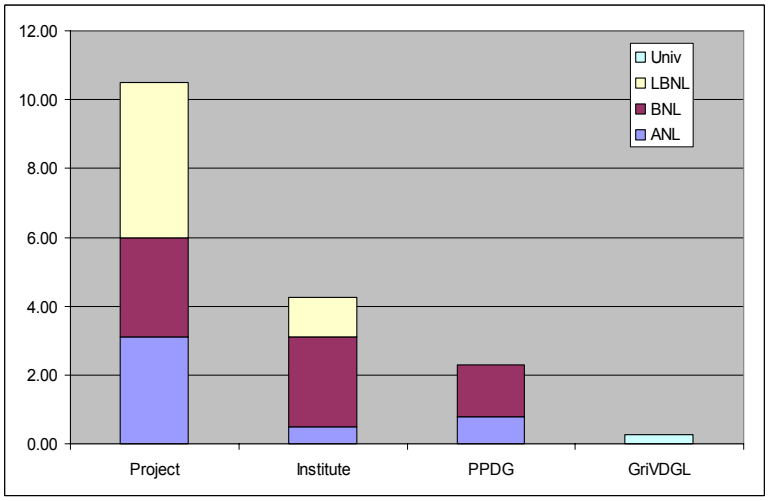
Software Activity in FY02

FTE breakdown by category and funding source



Software Funding in FY02

FTE breakdown by funding source and institute



FY02 Personnel

	Institute	Project funded FTE	Total FTE	Other support	Activity
Saul Youssef	BU	0.00	0.25	GriVDGL	grid
Greg Chisholm	ANL	0.50	0.50		DB
Steve Eckmann	ANL	0.50	0.50		DB
Chris Lain	ANL	0.00	0.50	lab	DB
David Malon	ANL	1.00	1.00		DB
Sasha Vanyashin	ANL	1.00	1.00		DB
New hire	ANL	0.00	0.80	PPDG, lab	grid
David Adams	BNL	0.00	1.00	lab, PPDG	event, grid
Pending hire	BNL	0.50	0.75	PPDG	DB, grid
Pending postdoc (Deng)	BNL	0.00	0.75	lab, PPDG	grid
Valeri Fine	BNL	0.50	0.50		DB
Yuri Fisyak	BNL	0.40	0.40		offl infra, support
Hong Ma	BNL	0.00	0.20	base	event
Pavel Nevski	BNL	0.60	0.80	PPDG	offl infra
Victor Perevoztchikov	BNL	0.20	0.30	PPDG	DB, grid
Srini Rajagopalan	BNL	0.00	0.30	base	event
Alex Undrus	BNL	0.80	1.00	PPDG	support
Torre Wenaus	BNL	0.00	1.00	base	mgmt, grid
Paolo Calafiura	LBNL	0.50	0.50		event, frame
Charles Leggett	LBNL	1.00	1.00		frame
Massimo Marino	LBNL	1.00	1.00		frame
David Quarrie	LBNL	1.00	1.00		arch, frame
Marjorie Shapiro	LBNL	0.00	0.40	base	frame, offl infra
Craig Tull	LBNL	1.00	1.00		frame
New postdoc (Lavrijsen)	LBNL	0.00	0.75	base	frame
Total		10.50	17.20		

Includes grid, US support, management effort as well as core effort.

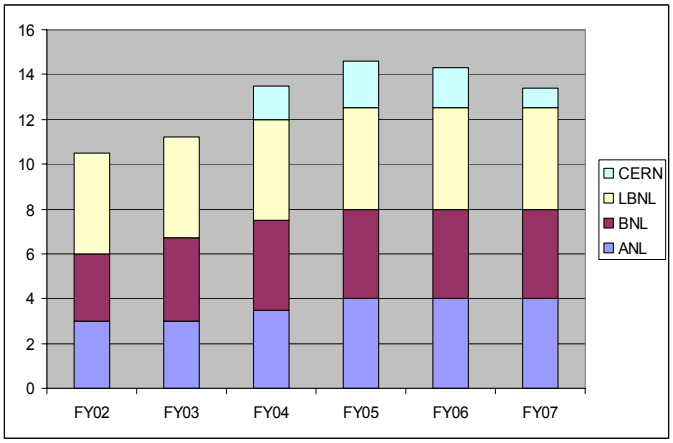
Green: new or newly active people since last November

FY03 Software Project Costs

Priority		FTEs	$		
	ANL	3	643500	3 developers	
1	BNL	4	720450	3 developers, 1 librarian	
	LBNL	4.5	1104000	4.5 developers	
	Total	**11.5**	**2467950**		
2	UC to ANL	0.5	107250	Compensate loss of UC effort	
	Total	**12**	**2575200**		
3	3 @ CERN	3	500000	Planned CERN complement	
	Total	**15**	**3075200**		

Guidance for FY03 is $2.4M

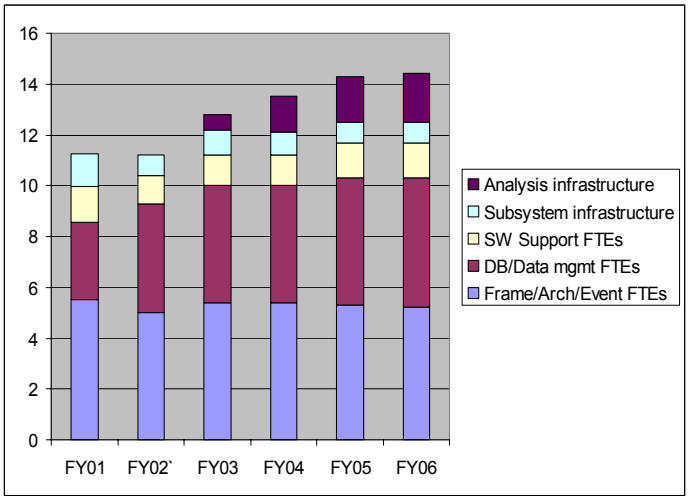
Funded FTEs based on profile



Reflects our priorities of achieving and sustaining critical mass efforts in our focus areas at the labs, complemented when funding permits by dedicated effort at CERN. Note that dedicated CERN effort peaks at 2 and rolls over into a decline by FY06.

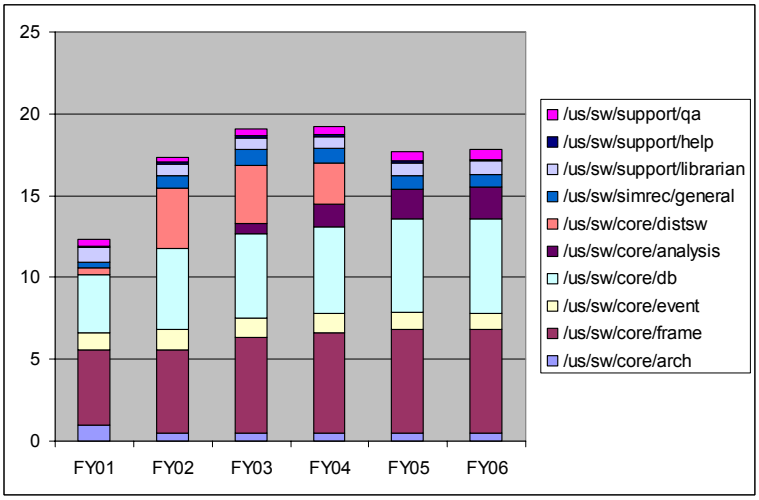
US Software Project Effort

FTEs in principal activities by fiscal year and category.



Total US Core Software Effort

FTEs by fiscal year and WBS category. Total effort from all sources.



Architect/Framework Needs Estimate

Estimate of Architecture (WBS 2.2.1.1) and Framework (2.2.1.2) effort needs for ATLAS

Estimated FTE totals by fiscal year required by the indicated WBS item for International ATLAS.

FY 01	FY 02	FY 03	FY 04	FY 05	WBS item
0.4	0.4	0.4	0.4	0.4	/sw/core/arch/chief
0.1	0.1	0.1	0.1	0.1	/sw/core/arch/proto
0.5	0.5	0.5	0.5	0.5	/sw/core/arch/usdp
0.2	0.2	0.2	0.2	0.2	/sw/core/frame/frame
0.2	0.2	0.2	0.2	0.2	/sw/core/frame/module
0.2	0.2	0.0	0.0	0.0	/sw/core/frame/jobopts
0.5	0.5	0.2	0.2	0.5	/sw/core/frame/intfc
0.5	0.5	0.5	0.5	0.5	/sw/core/frame/persistent
0.5	0.5	0.5	0.5	0.5	/sw/core/frame/transient
0.5	0.2	0.2	0.2	0.2	/sw/core/frame/conddb
0.3	0.1	0.1	0.1	0.1	/sw/core/frame/desc
0.2	0.2	0.1	0.1	0.1	/sw/core/frame/message
0.5	0.2	0.2	0.2	0.2	/sw/core/frame/stat
0.3	0.3	0.3	0.3	0.3	/sw/core/frame/analysis
0.2	0.2	0.2	0.1	0.1	/sw/core/frame/graphics
0.3	0.3	0.3	0.3	0.3	/sw/core/frame/config
0.2	0.0	0.0	0.0	0.0	/sw/core/frame/particle
0.5	0.5	0.5	0.5	0.5	/sw/core/frame/tools
0.1	0.1	0.1	0.1	0.1	/sw/core/frame/tbeam
0.2	0.3	0.7	0.7	0.7	/sw/core/frame/dist
0.0	0.2	0.3	0.3	0.3	/sw/core/frame/prod
0.2	0.2	0.2	0.2	0.2	/sw/core/frame/collab
0.2	0.2	0.2	0.2	0.2	/sw/core/frame/test
0.2	0.2	0.2	0.2	0.2	/sw/core/frame/doc
7	6.3	6.2	6.1	6.4	**Arch/Framework Totals FY01-05**

Database Needs Estimate

Estimate of Database (WBS 2.2.1.3) effort needs for ATLAS

Estimated FTE totals by fiscal year required by the indicated WBS item for International ATLAS.

FY 01	FY 02	FY 03	FY 04	FY 05	WBS item
0.3	0.3	0.3	0.2	0.2	/sw/core/db/design
1.0	0.7	0.5	0.0	0.0	/sw/core/db/eval
2.0	2.0	2.0	1.0	1.0	/sw/core/db/eventdb
0.5	0.5	1.0	1.0	1.5	/sw/core/db/metadata
1.0	1.0	0.5	0.5	0.5	/sw/core/db/simu
1.0	0.5	0.5	0.5	0.5	/sw/core/db/reco
1.0	1.0	1.0	1.0	1.0	/sw/core/db/tbeam
0.5	0.5	1.0	1.0	1.5	/sw/core/db/analysis
0.2	0.2	0.3	0.3	0.3	/sw/core/db/tdaq
0.8	0.5	1.0	1.0	1.0	/sw/core/db/conddb
0.7	0.5	0.2	0.2	0.2	/sw/core/db/frame
2.0	2.0	2.0	2.0	2.0	/sw/core/db/db
0.2	0.4	0.5	0.5	0.5	/sw/core/db/security
0.5	0.5	0.5	0.5	0.5	/sw/core/db/support
0.3	0.5	0.5	0.5	1.0	/sw/core/db/help
0.5	1.5	1.5	1.5	2.0	/sw/core/db/dist
0.7	0.7	1.0	1.0	1.0	/sw/core/db/grid
0.3	0.7	0.7	0.5	0.5	/sw/core/db/scale
0.2	0.6	1.0	1.0	1.0	/sw/core/db/admin
0.1	0.2	0.2	0.2	0.2	/sw/core/db/prod
0.2	0.2	0.2	0.2	0.2	/sw/core/db/collab
0.2	0.4	1.5	1.5	1.5	/sw/core/db/access
0.2	0.2	0.2	0.2	0.2	/sw/core/db/test
0.2	0.2	0.2	0.2	0.2	/sw/core/db/doc
14.6	15.8	18.3	16.5	18.5	**DB Totals FY01-05**

Planned & Required Effort Levels

FTEs by FY	FY01	FY02	FY03	FY04	FY05	
Arch/Frame	7.0	6.3	6.2	6.1	6.4	Needed
	5.6	5.6	6.3	6.3	6.3	U.S. provided (LBNL + BNL)
DB/Data mgmt	14.6	15.8	18.3	16.5	18.5	Needed
	3.6 (Grid: .5)	4.9 (Grid: 3.7)	5.2 (Grid: 3.6)	5.3 (Grid: 2.5)	5.7	U.S. provided (ANL + BNL)

Needs are based on bottom-up estimate of Int'l ATLAS needs from WBS level 5. Developed by U.S. software managers based on experience (developed by one of us, reviewed by other two; revisions were small). Broadly consistent with International ATLAS estimates.

Provided effort levels are the total of on- and off-project sources. Grid SW FTEs are shown separately in the DB section; they do not translate directly into ATLAS data mgmt FTEs.

Grid Comments

- We are following the funding mandates…
  - While the critical path task of event store development is resource starved 3 months before DC1, which is to include a full evaluation of implemented event store technologies to come to an already delayed decision,
  - we have a substantial and growing grid effort 15 months before the start of the first DC with grid objectives.
  - Point 2 is as it should be -- except in the presence of point 1
- We try hard to use grid resources in a way that furthers our priorities
  - eg. to develop metadata management of the sort needed for both distributed data management and a hybrid event store
  - but we are constrained: we must respect grid objectives and deliverables, and accept the substantial scope broadening required by working in the grid projects. Worthwhile in the long run, but not consistent with our needs in the short run when resources for the project proper are deficient.

Conclusions

- The project has **matured**, with successful programs at the three labs working closely with one another and with International ATLAS
- **Scope** of the program has been kept within the bounds of our plan
- The US continues to secure **important positions** in Int'l ATLAS software
- US work is **mainstream**, accepted, and often of central importance
- We are seeing the benefits of our major program elements (DB, framework, event) being closely **interrelated**: US developments leverage one another making the whole greater than the parts -- e.g. StoreGate leverages all three
- **Resource** shortages have made us dependent on a patchwork of funds supplementing project funds to meet our program, and this will continue until at least FY04 under the guideline profile. From FY04 we can support our core program under the profile with ~1-2 dedicated people at CERN (placing more at CERN will require relocating lab people)